LISTING OF THE CLAIMS:

Claims 1-8 (canceled)

9. (previously presented) An analog, oligomer-based method for determining a mathematical result of carrying out an operation of vector or matrix algebra on input data,

wherein single-stranded oligomers E_i and $\underline{E}_i$ are a subset of all single-stranded oligomers and are each in 1:1 correspondence with the basis vectors e_i, = 1, 2, ... m in an abstract m-dimensional vector space;

wherein a set of the oligomers Ei and $\underline{E}i$ represents an m-component vector $V = \sum_i V_i e_i$, wherein the E_i and $\underline{E}_i$ oligomers have complementary nucleotide sequences, with the E_i oligomers representing the i-th component of V for which the amplitude V_i is positive, and the $\underline{E}_i$ oligomers representing the i-th component of V for which V_i is negative; and

wherein the concentration of each of the oligomers E_i or $\underline{E}_i$ is proportional to the absolute value of the amplitude V_i of the i-th component of V,

the method comprising the steps of

(1) obtaining a composition comprising at least one set of single-stranded oligomers E_i and $\underline{E}_i$ representing the components of a vector, said composition comprising an oligomer representing a vector component with a positive amplitude and also comprising an oligomer representing a vector component with a negative amplitude, wherein the concentrations of the oligomers E_i or $\underline{E}_i$ in the composition are proportional to the absolute values of the amplitudes of the components they represent, which composition represents input data; and

(2) subjecting said composition to at least one physical or chemical treatment having an effect on said oligomers in said composition that is an analog representation of an operation of vector or matrix algebra, and

(3) detecting the effect of said treatment on said oligomers in said composition to determine the analog result of carrying out said operation of vector or matrix algebra on said input data;

wherein said analog result of carrying out said operation of vector or matrix algebra on said input data is quantitatively dependent on the concentrations of said at least one set of single-stranded oligomers E_i and $\underline{E}_i$ in said composition.

10. (previously presented) The method of claim 9, wherein the oligomers independently comprise subunits selected from the group consisting of deoxyribonucleotides, ribonucleotides, and analogs of deoxyribonucleotides or ribonucleotides; and any single oligomer comprises one or a combination of two or more of said different types of subunits.

11. (previously presented) The method of claim 10, wherein said at least one physical or chemical treatment in step (2) is selected from the group consisting of (a) changing the relative concentrations of the oligomers in said composition, (b) allowing complementary oligomers in said composition to hybridize to each other, (c) determining the concentration of double-stranded oligomers in the composition, (d) separating double-stranded oligomers from non-double-stranded oligomers in the composition, (e) measuring the rate of hybridization of complementary oligomers in, the composition, (f) ligating oligomers together, (g) adding oligomer subunits to an end, of an oligomer in an enzyme-catalyzed reaction, (h) using an oligomer as a template in synthesizing a

complementary oligomer sequence in a polymerase -catalyzed reaction, (i) phosphorylating or de-phosphorylating a 5' terminus of an oligomer, and (j) cleaving an oligomer with a restriction enzyme.

12. (previously presented) The method of claim 11 wherein said operation of matrix algebra is multiplication of a vector by a scalar, and

said method comprises changing the total concentrations of said oligomers in said composition by a factor equivalent to the scalar by which the vector is multipled, thereby obtaining an oligomer-containing composition that represents the product of multiplying said vector by said scalar.

13. (previously presented) The method of claim 11 wherein said operation of matrix algebra is addition of vectors, and

said method comprises obtaining, for each vector to be added, a set of single-stranded oligomers E_i; and $\underline{E}_i$; representing the components of the vector, wherein the concentrations of the oligomers E_i; and $\underline{E}_i$; are proportional to the absolute values of the amplitudes of the components they represent;

mixing together, for each vector to be added, an amount of the set of oligomers representing said vector that is normalized to be proportional to the sum of the absolute values of the amplitudes of the components of said vector;

allowing complementary oligomers in the resulting mixture to hybridize; and

separating the fully hybridized, double-stranded oligomers from the resulting mixture of oligomers, thereby obtaining a set of non-double-stranded oligomers that represents the sum of the added vectors.

Claims 14-17 (canceled)

18. (previously presented) The method of claim 37, wherein the oligomers independently comprise subunits selected from the group consisting of deoxyribonucleotides, ribonucleotides, and analogs of deoxyribonucleotides or ribonucleotides; and any single oligomer comprises one or a combination of two or more of said different types of subunits.

19. (previously presented) The method of claim 37 wherein each of said oligomers forming said content addressable memory matrix T_{ij} comprises, in order from the 5' end to the 3' end, (a) an oligomer strand comprising a nucleotide sequence representing an i-th component of *V* selected from the group consisting of E_i and $\underline{E}i$ for $i = 1$ to $i = m$, (b) an oligomer strand comprising a nucleotide sequence representing a j-th component of *V* selected from the group consisting of E_j and $\underline{E}_j$ for $j = 1$ to $j = m$, wherein $j \neq i$, and (c) a nucleotide sequence F that is not complementary to any sequence E_i or $\underline{E}_i$ for $i = 1$ to $i = m$.

Claims 20-21 (canceled)

22. (previously presented) The method of claim 37 wherein said single-stranded oligomers comprising a complete, substoichiometric set of E_i of step (c) and E_i are anchored to a solid support.

23. (previously presented) The method of claim 22 wherein said solid support is contained in a chromatographic column.

24. (previously presented) The method of claim 22 wherein said solid support is, or is attached to, a silicon or Al_2O_3 chip.

Claims 25-26 (canceled)

27. (previously presented) The method of claim 9 wherein said operation of matrix or vector algebra is determining the inner product of two vectors V and W, and said method comprises:

(i) obtaining for each vector V and W, sets of single-stranded oligomers E_i and $\underline{E}_i$ representing the components of the vector, wherein the concentrations of the oligomers E_i and $\underline{E}_i$ are proportional to the absolute values of the amplitudes of the components they represent; and

also obtaining a set of single-stranded oligomers E_i and $\underline{E}_i$ representing the components of vector $\underline{W}$ that are complementary to said oligomers representing vector W, wherein the relative concentrations of the oligomers representing $\underline{W}$ are proportional to the concentrations of their complementary oligomers in W;

(ii) combining samples of the oligomers representing vector V with samples of the oligomers representing vectors W and $\underline{W}$ in separate respective first and second reaction mixtures and measuring R_+ and R_- rates of hybridization associated with the respective first and second mixtures, and obtaining a numerical value proportional to the inner product of the two vectors from a difference between said R_+ and R_- rates of hybridization.

Claims 28-35 (canceled)

36. (currently amended) The method of claim 9, wherein said operation of matrix or vector algebra includes obtaining an outer product matrix of two vectors V_i ~~for i = 1, 2, ..., m,~~ and W_j ~~for j = 1, 2, ..., n,~~

wherein said step of subjecting comprises obtaining a set of dimeric, single-stranded oligomers to represent an outer product of vectors V and W, each of said dimeric oligomers comprising (i) a first single-stranded oligomer sequence selected from the group consisting of E_i or $\underline{E}_i$ for each i-th component of V ~~for i = 1, 2, ... m,~~ which oligomer is joined at its 3' end to the 5' end of (ii) a second single-stranded oligomer sequence selected from the group consisting of E_j or $\underline{E}_j$ for each j-th component of W ~~for all j = 1, 2, ... n,~~

wherein the step of detecting includes determining the concentration of said dimeric oligomers comprising oligomer sequences corresponding to the i-th component of V and the j-th component of W, said concentration corresponding to said outer product matrix.

37. (currently amended) A method for obtaining a data set V_i^b from an oligomer-based, content-addressable memory following input of a data set U_i^b that represents a portion of V_i^b,

wherein data elements in the form of m-component vectors $V = \sum_i V_i \mathbf{e}_i$ are represented in the memory by a set of the oligomers E_i and $\underline{E}_i$ that are a subset of all single-stranded oligomers and are in 1:1 correspondence with the basis vectors $\mathbf{e}_i$ for i = 1, 2, ...m in an abstract m-dimensional vector space;

wherein oligomers E_i and $\underline{E}_i$ have complementary nucleotide sequences, with E_i oligomers representing the i-th component of V for which the amplitude V_i is positive, and $\underline{E}_i$ representing the i-th component of V for which V_i is negative; and

wherein the concentration of each of oligomers E_i and $\underline{E}_i$ is proportional to the absolute value of the amplitude V_i of the i-th component of V;

the method comprising:

(a) preparing a content-addressable memory representing memory matrix T_{ij} in which are stored data sets corresponding to vectors V_i^a for a = 1 to a = n, where i = 1, 2, ..., m, wherein T_{ij} is the sum of all of the outer products $V_i^a V_j^a$ for $i \neq j$, the preparing of the memory representing the matrix T_{ij};

comprising obtaining for each vector V^a a set of dimeric single-stranded oligomers, each of which comprises a first single-stranded oligomer sequence selected from the group consisting of E_i or $\underline{E}_i$ for each i-th component of V^a for i = 1 to i = m, and further comprises a second single-stranded oligomer sequence selected from the group consisting of E_j or $\underline{E}_j$ for each j-th component of V^a for j = 1 to j = m, except for i = j; and then forming a memory pool of ~~pooling~~ said sets of dimeric oligomers obtained for each vector V^a for a = 1 to a = n to form the set of oligomers of the content-addressable memory representing the matrix T_{ij};

(b) combining said memory pool of dimeric oligomers with a set of oligomers representing partial data Set U_i^b under conditions wherein oligomer sequences E_i^b and $\underline{E}_i^b$ of data set U_i^b hybridize specifically to complementary sequences E_j and $\underline{E}_j$ present in said memory pool oligomers; and obtaining an isolated set of monomeric oligomer strands X_i comprising the first single strand oligomer sequences E_i and $\underline{E}_i$ of said memory pool of dimeric single stranded oligomers that

hybridized specifically to said U_i^b oligomers, wherein said X_i oligomers do not further comprise said E_j and $\underline{E}_j$ oligomers of the second single-stranded sequences of said memory pool oligomers that are complementary to said U_i^b oligomers;

(c) combining said set of X_i oligomers with a set of single-stranded saturating oligomers comprising a set of E_i and $\underline{E}_i$ oligomers representing the complete set of basis vectors e_i for $i = 1$ to m, wherein the E_i and $\underline{E}_i$ oligomers are substoichiometric relative to said set of X_i oligomers, in that the number of oligomers in the set of X_i oligomers is greater than the number of saturating oligomers, so that complementary sequences hybridize to each other, denaturing the resulting duplex molecules, and isolating the subset of X_i oligomer that hybridized specifically to said E_i and $\underline{E}_i$ sequences, to obtain a set of saturated X_i strands, S(Xi);

(d) repeating steps (b) and (c) iteratively, using the set of saturated X_i strands, $S(X_i)$ obtained in each previous implementation of step (c) as the set of oligomers representing partial data set U_i^b employed in the subsequent implementation of step (b), until successive iterations yield the same set of oligomer strands X_i produced by step (b) that represents data set V_i^b.